

IMPROVING THE WILD BLUEBERRY

FREDERICK V. COVILLE, Principal
Botanist, Division of Plant Exploration and
Introduction, Bureau of Plant Industry

IN 1906 the writer began a series of experiments to learn the fundamental facts in the life history of the blueberry, which might serve as a basis for the possible cultivation of this delicious wild fruit. It took 2 years to find that the blueberry plant requires an acid soil. These experiments showed also that trailing-arbutus, rhododendrons, azaleas, mountain-laurel, pinklady'slipper, and many other plants require acid soils.

Although every gardener today knows that blueberries, as well as hundreds of other kinds of plants associated with blueberries in their wild habitats, thrive only in acid soil, that fact apparently was not known to American horticulturists prior to these experiments with blueberries. The *Cyclopedia of American Horticulture*, published in four volumes in 1900, and prepared with the collaboration of more than 200 horticulturists and botanists of the United States, contains no mention that an acid soil is required for the successful cultivation of any one of these plants.

BEST WILD BLUEBERRIES CHOSEN FOR BREEDING PURPOSES

AFTER the soil-acidity requirement of blueberries had been determined, 2 years more were devoted to further studies of the life history of the blueberry, and by the end of 1910, when the first bulletin was published,¹ the blueberry had been grown successfully from seed to fruit; selected plants had been propagated by grafting, budding, division, layering, twig cuttings, and root cuttings; methods of pollination had been devised and applied; and wild plants with superior fruit had been chosen as the basis for breeding experiments.

¹COVILLE, F. V. EXPERIMENTS IN BLUEBERRY CULTURE. U. S. Dept. Agr., Bur. Plant Indus. Bull. 193, 100 pp., illus. 1910.



Figure 1.—Frederick V. Coville, assistant botanist and principal botanist, United States Department of Agriculture, 1888–1937; first breeder of blueberries and founder of the industry of blueberry culture.

DR. COVILLE died suddenly on January 9, 1937, only a few weeks after he had completed the article that appears herewith. It is fitting that his last paper deals with the greatest of his achievements in agriculture. His work in domesticating and improving the blueberry was based upon years of taxonomic, physiological, and genetic investigation of the wild blueberries of the eastern United States, and the flourishing industry fathered by his efforts rests upon a sure foundation of scientific knowledge.

Yet the blueberry achievement is but one of many in his chosen science, botany. In 1888, the year after his graduation from Cornell University, he entered the Department of Agriculture, and in 1891 he accompanied the famous Death Valley expedition in the capacity of botanist. As a result there was published in 1893 *Botany of the Death Valley Expedition*, one of the classics of the study of desert vegetation. Soon Coville was back again in the far West, investigating the useful plants of the American Indians and carrying on, in collaboration with the foresters of the Department, fundamental studies of the grazing and browse plants of the national forests. The present grazing-management policies of the Forest Service are the outcome, in large measure, of these investigations.

No one who had the privilege of being in the field with Dr. Coville could fail to be impressed by his keenness of observation and his constant appreciation of the beauty and the human appeal as well as the scientific interest of plants. The few examples of his work mentioned in the preceding paragraphs give only a partial view of his wide-ranging interest. He published no fewer than 158 scientific papers. Aside from his own special investigations, he played a leading part in such enterprises as organizing the research work of the National Geographic Society, establishing the Desert Botanical Laboratory of the Carnegie Institution of Washington, and founding the National Arboretum. With F. L. Olmsted and H. P. Kelsey, he edited that indispensable aid of the horticulturist, *Standardized Plant Names*. The writer well remembers Coville's delight, while the book was in preparation, when he or one of his colleagues would hit upon an apt and attractive English name for some plant hitherto known only in Latin or Greek.

Dr. Coville had a host of friends in all walks of life, to whom he was a patient and kindly counselor. Because of his reputation for sturdy good sense, people sought his advice, and he never begrudged for this purpose time that he could ill spare from his many occupations. The deep sense of loss his colleagues feel at his death is intensified by regret that he did not live to make one more trip to Death Valley, the scene of his first important botanical discoveries, as he had planned to do this spring. The popular flora of the Death Valley region he was engaged in writing would have been a most appropriate conclusion of a busy, useful, and happy life.

T. H. KEARNEY.

BROOKS BLUEBERRY

The first wild blueberry selected for breeding purposes was Brooks, named after the owner of the pasture at Greenfield, N. H., in which the plant was found. It was a highbush blueberry, *Vaccinium corymbosum* L. The berry was discovered in July 1908, after three summers of cursory observation in the mountains of southern New Hampshire and 3 weeks of diligent search in the summer of 1908. The bush grew at an elevation of 950 feet above the sea. It stood with many other blueberry plants in an old, brushy, mountain pasture, in acid and permanently moist but not swampy soil. It was about 7 feet high, and the largest of the several stems was about 2 inches in diameter. The plant was old, and the tops on some of the stems were partially dead. Other parts of the bush were in full vigor, with robust twigs and foliage. It yielded 3 quarts of berries. The berries were of large size, reaching a diameter of more than half an inch. The flesh was firm and juicy. The color was an unusually light blue, due to a dense bloom over the nearly black surface. In flavor the berry was exceptionally good. It was sweet, but sufficiently acid to be decidedly superior to the mild-flavored fruit of the lowbush blueberry, *V. angustifolium* Ait., yet not sour like the Canada blueberry, *V. canadense* Kalm, and it possessed in a high degree the flavoring ester that is the special characteristic of the best wild blueberries of New England. The delicious flavor of this wild blueberry from New Hampshire appears in all the cross-bred named varieties of blueberries except Jersey and Wareham, and the flavor of those two varieties would be more delicious if Brooks had been included in their ancestry.

This description of the Brooks blueberry has been given in detail because I regard its selection as of fundamental importance to the success of the Department's blueberry-breeding experiments. Every breeder of race horses or of milk cows understands that the choosing of the individuals to be interbred is of the highest importance. Plant breeders usually select carefully the species they intend to interbreed, but often make the mistake of paying too little attention to the choice of superior individual plants within the species.

ATTEMPT TO IMPROVE THE BLUEBERRY THROUGH
SELF-POLLINATION A FAILURE

THE first attempts to improve the blueberry by breeding were made in 1909 and 1910, when flowers on the original Brooks bush, and on plants propagated from it by grafting, by budding, and by cuttings, were pollinated by hand with Brooks pollen. These flowers did not set fruit, or the fruit withered and dropped long before it was mature, or if a few berries ripened they contained abnormally few seeds, most of these lacking embryos. No plants resulted from the sowing of these seeds. In later years self-pollination was tried repeatedly. In some instances a few plants were obtained from the few seeds resulting from such pollinations, but the plants were weak and they never produced fruit that was either desirable or abundant. This method of breeding, therefore, so successful with corn and with beans, was finally abandoned as a means of improving the blueberry. Before this subject is dismissed, however, it may be well to cite an experiment

in 1914 which shows how definite is the tendency to failure in self-pollination as compared with cross-pollination in the blueberry. On February 23 to 28 of that year 20 flowers on a hybrid blueberry plant known as 393C were pollinated with pollen from another hybrid blueberry, 394Y. Nineteen of these twenty cross-pollinated flowers set fruit and 19 berries ripened. On February 27 and 28, six flowers on 393C were pollinated with the plant's own pollen. From these six self-pollinated flowers no berries ripened. Five of the six flowers set fruit at first, but these all shriveled and dropped while they were still young and green. The failure of 393C to produce seeds when pollinated with its own pollen was not due to sterility of the pollen, for the pollen of this plant, when used in another experiment, on 394Y, yielded an abundance of berries and seeds from which many vigorous and productive plants were grown.

NUMBER OF CHROMOSOMES IMPORTANT

ANOTHER series of failures in the early blueberry pollinations was due to a cause quite different from self-sterility. Certain species of blueberry usually yielded no fruit when cross-pollinated, among them the lowbush blueberry and the Canada blueberry, species of similar size and habit, which occur together in enormous areas on both sides of the Canadian border; the highbush blueberry and the bigbush blueberry, *Vaccinium atrococcum* (A. Gray) Heller, which resemble each other so closely that Asa Gray considered one a variety of the other; and the highbush blueberry and the dryland blueberry, *V. vacillans* Kalm. When the two species of any of these pairs were cross-pollinated they usually produced no fruit. If, however, any berries resulted from the cross-pollinations, their few seeds produced weak and unproductive plants. In later years, cytological studies by Longley² showed that in each of these pairs the first-named species has 24 chromosomes; the other 12. The 12-chromosome species, it was found later, cross freely with each other. They even cross with the deerberry, which belongs to a related genus, *Polycodium*, but which has 12 chromosomes.

Among the 24-chromosome species of blueberry, crosses could be made easily, notwithstanding great differences in the physical appearance of the two species that were crossed. Not only were the highbush and the lowbush blueberry hybridized by artificial pollination, but natural hybrids between them are of frequent occurrence in New England pastures. The highbush blueberry grows to a height of 7 feet, with many stout stems in a single clump, and its leaves are commonly 2 to 2½ inches long by 1 to 1½ inches wide, the margins usually without teeth. The lowbush blueberry is 6 inches to a foot in height. It spreads by slender rootstocks into broad patches, and its leaves are small, narrow, and finely serrate. The highbush blueberry is easily crossed also with the myrtle blueberry of Florida, *Vaccinium myrsinites* Lam., a 2-foot species with evergreen, minutely-toothed leaves, which are seldom more than three-fourths of an inch in length. The highbush blueberry can be crossed easily also with the hairy blueberry, *V. hirsutum* Buckl., a southern-Appalachian species 2 to

² COVILLE, F. V. BLUEBERRY CHROMOSOMES. *Science* (n. s.) 66: 565-566. 1927.

LONGLEY, A. E. CHROMOSOMES IN VACCINIUM. *Science* (n. s.) 66: 566-568, illus. 1927.

3 feet high, with leaves densely pubescent on both surfaces, and with hairy, black berries. In a word, ease of crossing, among blueberry species of the eastern United States, is dependent on equality of chromosome number. Blueberry species of the most diverse appearance and characteristics, but with the same number of chromosomes, hybridize readily.

RUSSELL BLUEBERRY

The second wild blueberry selected for breeding purposes was Russell. It was brought to my attention in 1909 by Frank Russell as the best lowbush blueberry on his 600-acre mountain farm at Greenfield, N. H. The original plant had become so shaded by the low branches of a young oak tree that it no longer produced fruit, but in the greenhouses at Washington its berries reached a diameter of over nine-sixteenths of an inch. The berries were light blue in color, and they ripened earlier than those of Brooks. This tendency toward earliness appears in all the progeny of the Russell blueberry and is of great commercial importance because the earliest of the improved blueberries often bring the highest prices.

FIRST BLUEBERRY HYBRIDS

THE first cross-pollinations between Russell and Brooks were made in the spring of 1911. Some of the resulting first-generation hybrids were cross-pollinated with each other in 1913. The resulting progeny, about 3,000 hybrids of the first and second generations, was grown to maturity in the field, with remarkable results.

The outstanding characteristic of these hybrids was the variation in the color of their fruit. The berries of both Brooks and Russell are of light blue color. The body of the berry in both varieties is a dark purple, which appears as a black when the bloom is rubbed off. In the first-generation hybrids of Brooks and Russell the bloom was much thinner than in either parent, and in consequence the berries of the hybrids were dark blue in color, in strong contrast with the light blue berries of both parents. One of these first-generation hybrids is shown in figure 2. When two of these dark-berried first-generation hybrids were interbred the resulting second-generation hybrids showed a still more remarkable diversity of color. On about 65 percent of the plants the berries were dark blue, just as in the first-generation hybrids. On about 18 percent they were black, some of them a dull black, some without a trace of bloom, so that the berries had the shining appearance of a black shoe button. On about 15 percent of the plants the berries were light blue, like the berries of both grandparents. On about 1.5 percent the berries were albinos. They lacked the purple coloring matter that, located in the skin of the blueberry, gives the fruit the black color that appears when the bloom is rubbed away. Further comments on these albino blueberries are given later in this paper under the varieties Redskin and Catawba. On about 0.5 percent of the plants the heavy bloom of the berries on the two grandparents was replaced by an apparently still denser and lighter colored bloom which gave the berry a metallic luster like that of new aluminum ware.

A shining black color in these blueberry hybrids was never found associated with a delicious taste, perhaps because there was not a

sufficient number of such plants to afford an adequate range in flavor. The same was true of the "aluminum" berries. In the dark-colored berries excellent flavor and good size were often combined. These



Figure 2.—One of the first blueberry hybrids. This is a first-generation cross between a wild highbush blueberry, Brooks, and a wild lowbush blueberry, Russell, from Greenfield, N. H. Another hybrid of the same parentage, 394Y, was one of the ancestors of the varieties Rancocas, June, and Weymouth. (Natural size.)

dark-berried bushes of 2- to 3-foot stature are of frequent occurrence in New England pastures as natural hybrids between *Vaccinium corymbosum* and *V. angustifolium*. Such a hybrid is the plant described in Gray's Manual of Botany and Rehder's Manual of Cul-

tivated Trees and Shrubs as *V. corymbosum amoenum*.³ About Greenfield, N. H., the plants of such hybrids are popularly known as the half-high blueberry. For many years I regarded this plant as a distinct species, until it appeared by hundreds among the artificial hybrids.

SOOY BLUEBERRY

An important step forward in blueberry breeding came about by enlisting the interest of wild-blueberry pickers in New Jersey through cooperation with Elizabeth C. White, of New Lisbon, N. J. On July 20, 1911, I stopped at the house of Ezekiel Sooy, an experienced picker of wild blueberries, living at Browns Mills. It had been stipulated that a wild blueberry, to be valuable, must be half an inch in diameter. Mr. Sooy said that he hadn't any half-inch blueberries for me, that all the good bushes had berries much larger than that. He proceeded to take me to one of them, near the road, a mile east of his house. The berry proved to be a beauty, five-eighths of an inch in diameter. I started to arrange that a portion of the bush be taken up later when the plant was dormant, but Mr. Sooy took hold of a rooted sucker about an inch in diameter and ripped it from the ground with a forceful yank. I had been in the habit of treating blueberry plants with consideration and when I protested that the plant had been taken up neither at the proper season nor in the proper manner, Mr. Sooy said, "That root will grow. You can't kill a blueberry bush." So the top was cut off and the root was wrapped in a wet newspaper and taken to Washington, where under the name Sooy it became one of the progenitors of some of our best blueberry hybrids.

Brooks and Sooy were cross-pollinated in 1912. Nearly 3,000 seedlings of this parentage were grown to maturity in the field. Among them were two plants that when propagated from cuttings became the improved blueberry varieties Pioneer and Katharine.

THOUSANDS OF PEDIGREED SEEDLING BLUEBERRIES TESTED TO OBTAIN 15 NAMED VARIETIES

UP TO the year 1936 about 68,000 pedigreed blueberry seedlings have been fruited and carefully examined to determine which were sufficiently valuable to be propagated and distributed as named varieties. The ancestry of each seedling is a matter of record. In the testing plantations it was sometimes evident from the characteristics of an individual plant that it did not belong to the group indicated by the record. Somewhere during its life, when it was placed in the ground as a seed, or when it was potted in the greenhouse, or when it was packed for shipment, or when it was placed in the field nursery, or when it was set in its final place in the testing field, it was exchanged with another plant that had a different history. It happens, however, that none of these evidently misplaced plants has proved to be of such high quality that it deserved to be named. We are able to say, therefore, that the ancestry of our named varieties of improved blueberries is above suspicion.

³ GRAY, A. MANUAL OF BOTANY OF THE NORTHERN UNITED STATES. Ed. 6, 760 pp., illus. New York and Chicago. 1890

REHDER, A. MANUAL OF CULTIVATED TREES AND SHRUBS HARDY IN NORTH AMERICA, EXCLUSIVE OF THE SUBTROPICAL AND WARMER TEMPERATE REGIONS. 930 pp., illus. New York. 1927.

TESTING BLUEBERRIES

THE selection of the few best plants in a field containing thousands of individual pedigreed blueberry seedlings is a tedious business. It requires sustained attention and keen and repeated observations. As one walks down the rows, the desirable color of an exceptionally light-blue berry can be observed almost at a glance. If, however, the branches of the plant are unusually flexible, the wind swaying a heavy cluster of berries against a neighboring branch may wipe away the bloom and disfigure the berries by leaving them black on one side. Stiffness of branch is needed to insure uniformity in the color of the berries.

To be sure of the size of a blueberry, one's judgment needs to be checked continually with a gage. The gage illustrated in figure 3 was in use for several years until its largest hole, 25 millimeters (an inch is 25.4 mm), was found to be too small to measure the largest hybrid blueberry. This is the one described later in this paper as GM37 and illustrated in figure 4. The original Brooks blueberry slightly exceeded 14 mm, the Russell blueberry 15 mm, and the Sooy blueberry 16 mm. Our largest hybrid that has a delicious flavor has thus far attained only 24 mm in diameter.

The ease of picking and the size of the scar on the blueberry where it separates from its stem are important. A small and dry scar is the most desirable, and such a scar is usually associated with ease of picking. Further notes on difficulty of picking are given later under the variety Katharine, and on ease of picking under the variety Rancocas. An undesirable feature was observed in some of the seedlings when the joint at the base of the stem of the individual berry separated more easily than the joint at the upper end of the stem, and the stem therefore remained attached to the berry when it was picked. Such a berry is undesirable commercially.

In many of the seedlings the skin at the base of the blueberry tends to remain attached to the stem and, in picking, a piece of skin is torn from the berry. A seedling bearing such berries is always rejected, however good its flavor and other qualities.

The keeping quality and the firmness of flesh must be considered in selecting a blueberry, because under commercial conditions berries without these qualities may not reach the consumer in good condition. A blueberry is often rejected if it has a very large calyx. Such a calyx may afford a place for an insect to hide.

Occasionally the ripe fruit of a blueberry tends to crack after a rain. The crack may come between the calyx lobes, where the skin is sometimes tightly stretched as the berry enlarges and ripens, or it may form about the middle of the berry. Several blueberries of large size and delicious flavor have been rejected because of their tendency to crack.

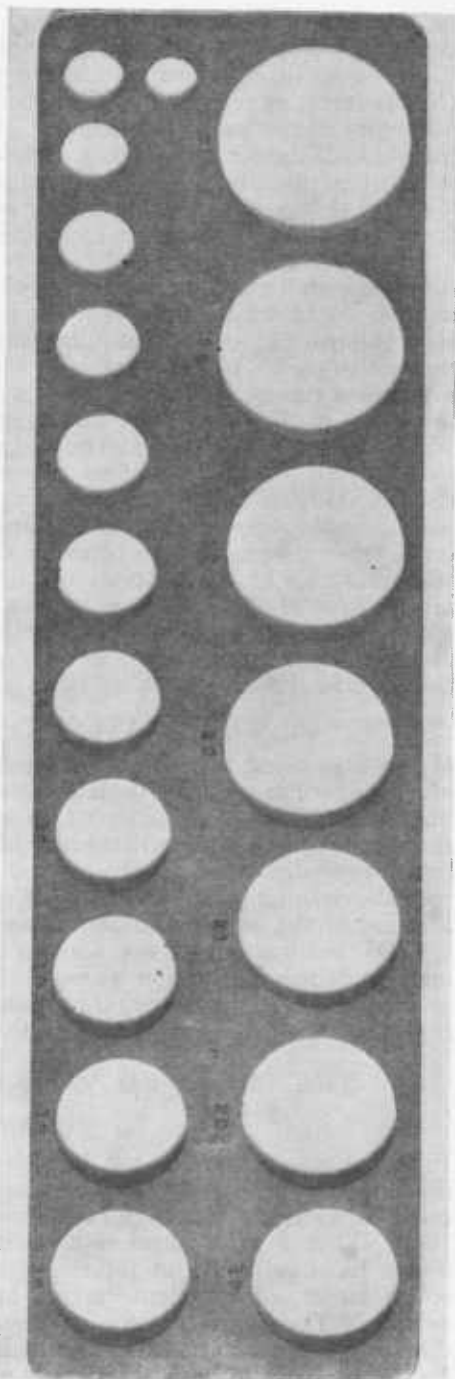
TESTING FOR FLAVOR

Probably the most elusive and difficult thing to judge in a new blueberry is its flavor. After several hours of tasting, all blueberries taste alike, and they all taste sour. On a day in which many blueberries are to be tried for flavor, I never swallow the berries I am tasting, and I taste only those that appear promising from their size

and other visible qualities. Even with such precautions to conserve one's ability to distinguish flavors, it sometimes is necessary to stop work in the field until one's organs of taste have recovered their faculty of discrimination. If a blueberry is to be eaten in a pie, its flavor is of secondary importance, for if it has not sufficient acidity a teaspoonful of vinegar, or its equivalent in lemon juice, will supply the deficiency; but if the blueberry is to be eaten as a fresh fruit, either out of hand or with cream and sugar, its flavor, its seedlessness, and its succulence are its chief contributions to enjoyment.

A blueberry is sweet, slightly sweet, or quite without sweetness. It may be sour, slightly acid, or flat. It may have none of the special flavor of the blueberry, or a little of it, or this flavor may be present in a high degree. Its flesh may be lacking in juiciness, or it may be juicy and sprightly. When taken directly from the bush, the blueberry varies in taste with its degree of ripeness. When blueberries first turn blue they usually are still sour. When they have been blue about a week they commonly are ready for picking, but the berries of some of the varieties with relatively sour fruit may need to remain on the bush for 2 or even 3 weeks after they turn blue, before they become really palatable.

Figure 3.—A blueberry gage, the holes from 7 mm (a little more than a quarter of an inch) to 25 mm (a little less than an inch) in diameter. The largest blueberry thus far grown is a little larger than the largest hole in this gage.



Individual preferences vary regarding the taste of blueberries. Some persons prefer a blueberry so sour that it cannot be eaten without liberal quantities of sugar. My own preference is for a blueberry that is juicy, sweet, with a slight acidity, and with the characteristic blueberry flavor highly developed. If such blueberries are sound, and for about 2 days after picking, can be kept in a shady, breezy place, without refrigeration, preferably until they have begun to shrivel very slightly, they are then in their ideal condition for flavor, and are ready to go into the refrigerator for chilling before they are served.

In the field it has seemed difficult to find a satisfactory flavor in a blueberry on a very hot day. Whether the fault is with the blueberry or with the taster I cannot say. In tasting blueberries in the field, one may easily make an error of judgment if the berry he tastes is blue but not really ripe. If the berry is in an underripe condition it will have a purplish color around the scar where it separated from its stem. If the berry is of normal color and is fully ripe the area around the scar will be of the same color as the rest of the berry.

To avoid the introduction of new blueberry varieties that are chiefly valuable to the grower only, because of their productiveness and their shipping quality, it has been the aim of the Department, in its blueberry breeding, to consider the consumer also, and especially to develop for his benefit varieties of high flavor. As evidence of the faithfulness of this endeavor it may be recorded that more than 300 seedling blueberry plants that bore berries over three-quarters of an inch (19.1 mm) in diameter have been destroyed because they did not come up to the standards we have set for flavor.

PROPAGATING NEW VARIETIES

When a seedling is of such high quality that it is considered worthy of propagation and distribution as a new and named variety, single buds taken from it are inserted, in midsummer, near the base of new shoots that have grown from older blueberry plants cut to the ground in the preceding winter. In the following spring each shoot is cut off just above the inserted bud, and no other bud is allowed to grow. By the end of the season the plant has a top of nearly the same size as the top that was cut off two seasons before, and this new top furnishes many cuttings of the new variety. By this procedure a new variety of blueberry can be propagated many times more rapidly than if the cuttings were taken directly from the single original plant.

THE IMPROVED VARIETIES OF BLUEBERRY

PIONEER

PIONEER was so designated because it was the first named variety developed as a result of blueberry breeding. It was a first-generation cross between the wild highbush blueberries Brooks and Sooy, made in 1912. Like all the improved varieties not otherwise described, its leaves have no teeth on their margins. Its berries are of light blue color, sweet, of excellent flavor, and when fully ripe are without acidity. The largest berry on the original bush was 18.5 mm in diameter. Young Pioneer plants in commercial fields have borne berries up to 19.7 mm. Pioneer is a midseason variety.

GREENFIELD

Greenfield was a second-generation hybrid between Brooks, a highbush blueberry, and Russell, a lowbush blueberry, both of them wild plants from Greenfield, N. H. The leaves of Greenfield were finely toothed. The seed from which the plant was grown came from a cross-pollination made in the spring of 1913. The variety never became established in commercial blueberry culture, and is recorded here only for the purpose of accounting for the name.

CABOT

The Cabot blueberry is a first-generation hybrid between two wild highbush blueberries, Brooks, already described, and Chatsworth, which was found near the settlement named Chatsworth, in the pine barrens of New Jersey. The cross-pollination was made in 1913. The bush was named for my son, Cabot Coville, now secretary of the American embassy at Tokyo, who chose this bush for the flavor of its berries, which have a slight acidity, in preference to the sweet, nonacid berries of Pioneer. Cabot is an early variety, for many years the earliest of the named varieties, and in consequence it has been planted very extensively by blueberry growers. It has been found desirable to pick its berries about twice a week, and a bush sometimes yields as many as seven pickings. The berries on the original bush reached a diameter of 18.5 mm. For some obscure reason the fruit buds of the Cabot blueberry, in late winter, are a morsel fascinating to deer. At the blueberry plantation known as the Ore Ponds, a few miles west of Toms River, N. J., the deer almost denuded the Cabot bushes of their fruit buds in the early spring of 1928. In consequence of this excessive pruning by deer, the remaining buds produced berries up to 20.5 mm in diameter, an unusually large size for this variety.

KATHARINE

The Katharine blueberry is of the same parentage as Pioneer. It was a first-generation cross between the wild highbush blueberries Brooks and Sooy, from a pollination made in 1913. The berries are light blue and of especially delicious flavor. On the original bush they reached a diameter of a little over 19 mm. Occasionally in commercial plantations they reach 20 mm. The Katharine is hard to pick. The berry clings tenaciously to its stem, and when it is pulled away a hole is often torn in the base of the berry. The injury detracts from both the appearance and the keeping quality of the berries, yet in spite of this defect the Katharine is a variety that has been very satisfactory to the consumer. The Katharine is named after my daughter, Katharine, now Mrs. Chester C. Woodburn, of Des Moines, Iowa, who in one of her high-school years did all my blueberry pollinations. The variety ripens a little later than Pioneer.

RANCOCAS

One of the parents of Rancocas was an unnamed blueberry hybrid known as 394Y, a first-generation cross between Brooks and Russell. The other parent was a wild blueberry from the pine barrens of New Jersey named Rubel. This is, in form, the German spelling of the

name of the old Russian coin, the rouble. The name of the blueberry variety Rubel, however, is of neither German nor Russian derivation. The man who discovered this bush was Rube Leek. Rube did not seem an expressive name for a berry that was blue and beautiful, and Leek was suggestive of a flavor that the berry did not possess. Rubel was a compromise, made up of Mr. Leek's first name and the initial of his last. The seed from which the Rancocas bush grew was the result of a pollination in the spring of 1915. Rancocas is a second-early variety, ripening its berries later than Cabot and earlier than Pioneer. The original bush bore berries up to 18 mm in diameter. Berries in commercial plantations sometimes exceed 19 mm. Rancocas tends to the production of heavy crops on young and healthy bushes, so heavy indeed that unusual care must be taken to prune the bushes severely in order to insure a good crop in the following year. The leaves of Rancocas have finely toothed margins. The berries have a small, dry scar and are very easily picked. The name of this variety came from Rancocas Creek in New Jersey. Near this creek was the blueberry plantation in which the variety gave its first satisfactory performance.

JERSEY

The variety Jersey was so named because both its parents were wild plants from New Jersey. These parents were Rubel, already described under Rancocas, and Grover, discovered by Russell Grover. The two were cross-pollinated in 1916. Jersey is a variety maturing late in the season, so late in fact that its berries often bring a high price, in northern plantations, because of its lateness. This and other late varieties extend the blueberry-picking season over a period of about 8 weeks, the early varieties beginning to ripen in New Jersey in the latter part of June and the late varieties continuing until the middle of August and sometimes later. The berries of Jersey are large, up to 22.4 mm in diameter, and, until dead ripe, too acid for the taste of most persons. Jersey is of remarkably robust growth, the leaves on vigorous shoots sometimes attaining a length of 4 inches and a width of 2¼ inches.

CONCORD

The Concord blueberry was so named because of its large clusters of berries, which, all ripe at the same time, resemble clusters of Concord grapes. It is a first-generation hybrid between the wild highbush blueberries Brooks and Rubel and came from a cross-pollination in 1917. The original bush bore berries up to 18 mm in diameter. In field culture its berries sometimes reach a diameter of 20 mm, occasionally 21 mm. Concord berries are delicious when they are allowed to remain on the bush until they are fully ripe and have lost the excessive acidity they possess when they first turn blue. Concord is a midseason variety, ripening at about the same time as Pioneer.

JUNE

June, named for its early ripening in New Jersey, is of the same parentage as Rancocas, but from cross-pollinations made in 1919. On the original bush the berries reached a diameter of 20 mm. In commercial plantations they have sometimes exceeded 21 mm. The berry

is of medium blue color, sweet and delicious when fully ripe, with a slight subacidity. It usually ripens earlier than Cabot. Although June is of one-fourth lowbush ancestry, its leaf margins do not have the teeth that characterize its lowbush grandparent.

SCAMMELL

The Scammell blueberry is named for H. B. Scammell, of Toms River, N. J., who first showed how good are the qualities of this berry under field conditions. One of the parents of the Scammell was a cross between the wild blueberries Brooks and Chatsworth. This Brooks-Chatsworth parent, which was never planted in the field, was recorded in the greenhouse in Washington as having "berries of delicious taste, sweet, slightly acid and of pronounced flavor." This plant was pollinated with Rubel pollen in 1915, and the Scammell blueberry was one of the resulting seedlings. In the field the original bush of Scammell bore berries up to a diameter of 20.5 mm. On budded plants in the greenhouse in Washington they reached more than 22 mm. The berries have a medium blue color, firm texture, and a small scar, and the calyx is almost wanting. The leaves are smaller than on most varieties of highbush ancestry, commonly $1\frac{1}{2}$ to 2 inches in length and five-eighths to three-quarters of an inch in width. The berries are sweet, subacid, and have a high degree of flavor. They ripen in late midseason. Among New Jersey growers there has been little planting of this variety, apparently from doubt regarding its vegetative vigor. In North Carolina, however, at the Double Trouble Company's blueberry plantation near Magnolia, it is regarded as one of their best varieties.

STANLEY

The Stanley resulted from a cross between the Katharine blueberry and the wild Rubel bush, made in 1921. By many persons Stanley is considered the most delicious of all blueberries. The original bush bore berries a little less than 18 mm in diameter. From the first its berries were recognized as of especially delicious flavor. It is named for my son, Stanley, on whose blueberry plantation at New Lisbon, N. J., this variety was first shown to be capable of producing good yields of berries of large size. Its berries often exceed 19 mm in diameter and sometimes 20 mm. In one instance a Stanley berry reached a diameter of 21 mm and in another instance 22 mm. The Stanley blueberry is a late midseason variety.

REDSKIN

The Redskin blueberry is an albino, a second-generation hybrid between the wild highbush blueberry Brooks and the wild lowbush blueberry Russell. The original Redskin plant came from a pollination made in 1913. Albino blueberries become red on the side exposed to the sun. In the Redskin blueberry the red is almost that of old mahogany, with only a trace of bloom. The berry sometimes exceeds 16 mm in diameter, and the flavor is good. The berry ripens early in the season. This variety and the next, Catawba, were given names in 1932 because as red-cheeked albinos they are horticultural curiosities. The fair size and good flavor of their berries make them desirable additions to a collection of blueberry varieties for a home garden. It

is doubtful whether any albino blueberry will ever acquire importance as a market fruit. The white color of the shaded half of the Redskin berry gives the fruit a mottled appearance after picking, and on any slight bruise the injured portion of the flesh turns to a dried-apple color, both of these features making the fruit uninviting to a purchaser. The leaves of Redskin are finely toothed. This variety should be pruned at the end of the growing season by the removal of all the stems that fruited in the preceding summer, only the season's sprouts being left. When so pruned, Redskin hardly reaches a height of 2 feet. This low stature, which allows the plants to be kept covered with snow very easily during the bitter cold of a northern midwinter, suggests Redskin as a desirable variety in places so far north that other and taller varieties project through the snow and lose their fruit buds by winter-killing.

CATAWBA

The Catawba blueberry is an albino which was bred from the same grandparents and the same parents as Redskin, and in the same year. The berries of Catawba are not so large as those of Redskin, nor is their flavor quite so good. They have more bloom, and the red of the berry is therefore paler than in redskin, more like the color of the Catawba grape, a resemblance that suggested the varietal name. The leaves of the Catawba are finely toothed, and the plants reach a height of about 4 feet.

WAREHAM

In the autumn of 1916 some 300 pedigreed but untested blueberry seedlings were sent to the cranberry substation of the Massachusetts Agricultural Experiment Station, East Wareham, Mass., to be brought into fruit by H. J. Franklin, in charge of the cranberry substation. Among these seedlings was one that, after several years of observation, Professor Franklin thought was of sufficient merit to be named and distributed. In accordance with his wish it was named Wareham. The parents of the Wareham blueberry were the wild New Jersey highbush blueberry Rubel and another wild New Jersey highbush blueberry named Harding, after its discoverer, Ralph Harding. The cross-pollination was made in 1915. The original bush of the Wareham blueberry, in the late summer of 1931, had a breadth of 9 by 9 feet and a height of 6 feet. It was vigorous and had produced 8 quarts of berries that season. It differed from most other tall varieties of blueberries improved by breeding in having serrate leaves, like its Harding parent. When I saw the bush again, on July 28, 1933, its berries had not yet been picked. Several were over 19 mm in diameter, some of them nearly 20 mm. Wareham is a late-season variety, its berries maturing at about the same time as Jersey. Until they are dead ripe they are a little too acid for the taste of most persons. When fully ripe they are sweet-subacid and of good flavor.

WEYMOUTH

The Weymouth is named for the cranberry and blueberry plantation of Weymouth, at which most of the Department's testing of new pedigreed blueberry seedlings has been conducted since 1929, between Hammonton and Mays Landing, N. J. It is near Weymouth Furnace, long ago abandoned, at which cannon and cannonballs were

made from bog iron ore during the War of 1812. The Weymouth blueberry is a cross between the two early varieties June and Cabot. The pollination was made in 1928. Although the earliness of Weymouth is not yet satisfactorily proved from commercial field experience, the original bush bore berries that reached nearly 22 mm in diameter and ripened much earlier than Cabot. The berries have only a moderate degree of acidity in the early stage of their ripening, and they are sweet, subacid, and delicious when they are first picked. They lose much of their taste if they are allowed to become overripe.

GM37

There is one seedling blueberry that, although barred from commercial culture because its berries are deficient in flavor, has other such desirable qualities, including the extraordinary size of its fruit, that acquaintance with this unnamed bush ought to be shared with the public. It is known in our records as GM37. It is a cross between Jersey and Pioneer, and therefore has four wild highbush ancestors, Grover and Rubel, the parents of Jersey, and Brooks and Sooy, the parents of Pioneer. The pollination from which GM37 came was made in 1925. The original bush produced berries in 1928 over 20 mm in diameter, in 1929 over 21 mm, and in 1930 nearly 23 mm. In 1933 a budded bush of GM37, hand-pollinated and screened, in a New Jersey blueberry plantation, produced berries up to 25.9 mm, a little over an inch, in diameter. (An inch is 25.4 mm.) A cluster of berries from this bush is illustrated, natural size, in figure 4. The reader should bear in mind that this is the largest blueberry ever produced, but it lacks the flavor required to warrant making it a named variety. For breeding purposes, however, GM37 has great value, as will be evident from what is said under the next variety, Dixi.

Dixi⁴

The unnamed blueberry GM37 lacked only flavor to make it a valuable variety. In 1930 it was cross-pollinated with the Stanley blueberry, the most delicious of all varieties. Among the progeny was a bush that attracted attention first in 1935 and again in 1936. Its berries are sweet-subacid and delicious. On July 9, 1935, the largest berry was over 21 mm in diameter, and on July 24 of that year over 23 mm. On July 24, 1936, the largest berry reached 24 mm. If the season of 1936 had been a favorable one for the development of large individual blueberries, I am confident that the berries on this plant would have reached a diameter of more than an inch. There is now only a single bush of this variety. It will be several years before it can be propagated for a thorough field test of its qualities. Nevertheless, there are circumstances that seem to make it desirable to give a name to this variety at this time. Toward the end of the present fiscal year I terminate my connection with the Department of Agriculture after 49 years of botanical research. It was the custom of Linnaeus and other scientific men of his time, when a

⁴Blueberry growers should be careful not to misspell the name of the Dixi blueberry, for the wrong spelling "Dixie" may give the erroneous impression that this variety is especially adapted to cultivation in the South. The ancestors of the Dixi blueberry were northern plants, and although the variety may be of value as far south as North Carolina, there is every reason to expect that it will not thrive in the Gulf States.

public address was given in Latin, to end the address with a Latin word that meant "I have spoken," "I have said what I have to say," or "I am through." Therefore, with orthographic apologies to the southern half of the United States, I name this blueberry and end this paper with that Latin word—*Dixi*.



Figure 4.—A cluster of the largest blueberries thus far grown. (Natural size.) The largest berry on this bush was 25.9 mm (a little more than an inch) in diameter. This bush, known in our records as GM37, was not made a named variety because its berries were not up to our standard of flavor. It has been cross-bred, however, with the most delicious variety of blueberry, Stanley. Among the off-spring is the large and delicious blueberry described in this paper as *Dixi*, which already, as a young plant, has produced berries nearly as large as those shown in this illustration.